

The Motorola R-2660: A Basic Description.

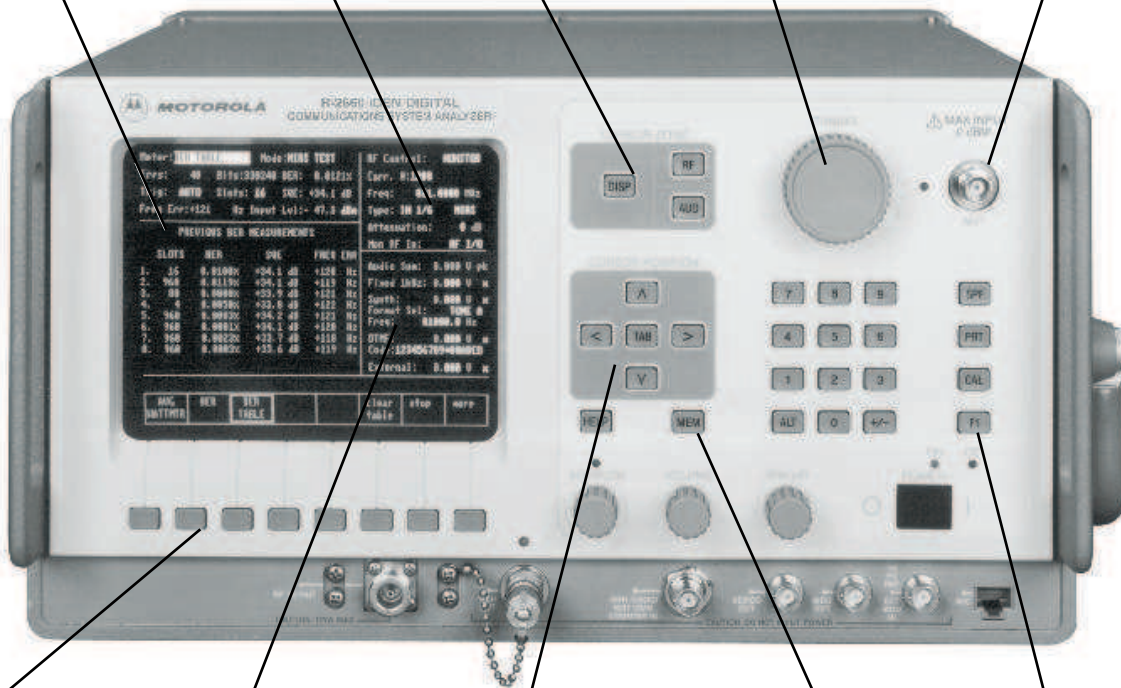
Display Zone for presentation of test data and waveforms

RF Control Zone for selecting RF test conditions

Cursor Zone keys provide simple, one-button access to any zone

Tuning Knob for easy change of any numeric entry: digital precision with an analog feel

Off-the-air antenna port for sensitive receiver measurements



User-friendly, soft-touch keys for feature selection

Audio Control Zone for setting modulation conditions

Cursor Position keys allow instant cursor movement within a zone

Memory recall for up to 30 channels including automatic scanning plus 15 optional user-programmable test setups

Operator-selected, one-button access to special functions, printing and self-calibration

R-2660 . . . Supports Motorola iDEN TDMA Radio Systems

From the company that brought you iDEN (Integrated Dispatch Enhanced Network) and the R-2600, Motorola presents the R-2660 Communications System Analyzer. As an addition to Motorola's test equipment family, the R-2660 is designed to provide fully compatible testing of iDEN radio systems.

Whether you're testing subscriber units or site equipment, the R-2660 offers the unique capability to test iDEN systems under actual TDMA operating conditions in either 6:1 or 3:1 format. Comprehensive diagnostic capabilities are provided to facilitate fault isolation and repair. In addition, the unit also provides dedicated screen displays for convenient observation or printout; innovative use of soft keys and windowing; fast reacting autoranging scales with both analog and digital readouts; and signaling encode and decode functions – all built into a versatile, rugged, and compact test unit designed specifically to meet the tough demands of the field service environment.

In TDMA mode, the R-2660 provides the following special measurement features:

- Average power meter
- Frequency error meter
- SQE (Signal Quality Estimate)
- BER (Bit Error Rate)

In addition to offering all the standard system features, the R-2660 also includes several high performance features for testing more sophisticated systems.

R-2660 Standard System Capabilities

iDEN-Specific Test Capabilities

- Supports both 6:1 and 3:1 TDMA format
- Subscriber unit testing in dynamic call simulation mode including vocoder for live voice testing
- Subscriber unit testing in test mode
- Base site transmitter testing under operating conditions
- Base site receiver BER testing

General Diagnostic Features

- Tracking generator
- Cable fault locator
- High stability oscillator
- Enhanced spectrum analyzer with markers
- Test memory presets

iDEN Subscriber Unit Testing

Feature	Description	Benefits
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Dynamic Call Simulation Mode

Meter: CALL INTRNCY Mode: IDEN MOBILE		RF Control: DUPLEX																
Mon Freq: 820.8125 MHz	SQE: +26.3 dB	Carr. #:1185																
Slots:16	Lvl:+ 33.5 dBm	Mon Freq:820.8125 MHz																
Gen Freq: 865.8125 MHz	Lvl:125.74 uV	Offset: +45.0000 MHz																
		Format: IDEN																
Call Seq: 1-2-3-4-5-6-7-8-9		Mon: 40 dB RF I/O																
Status: Measurement State		Gen: -865.8dBm RF I/O																
IMEI: 0001 00000238 07 0		Audio Sum: 0.00 U pk																
Called Party Number : 4417538		Fixed 1kHz: 0.00 U x																
Classmark Information: Rev: 0 Pwr: 33 dBm		Synth: 0.00 U x																
		Format Sel: TONE A																
		Freq: 01000.0 Hz																
Mobile Detected Signal Strength:- 72 dBm	External: 0.00 U x																	
<table border="1" style="width:100%; text-align: center;"> <tr> <td>AVG</td> <td>INITIAL</td> <td>6:1</td> <td>3:1</td> <td>DIS</td> <td></td> <td>stop</td> <td>more</td> </tr> <tr> <td>WATTMTR</td> <td>REG</td> <td>INTRNCY</td> <td>INTRNCY</td> <td>PATCH</td> <td></td> <td></td> <td></td> </tr> </table>			AVG	INITIAL	6:1	3:1	DIS		stop	more	WATTMTR	REG	INTRNCY	INTRNCY	PATCH			
AVG	INITIAL	6:1	3:1	DIS		stop	more											
WATTMTR	REG	INTRNCY	INTRNCY	PATCH														

Test Motorola-compatible iDEN mobile and portable radio units under actual signaling conditions by simulating the function of the fixed-end system. The radio accesses the control channel, performs initial registration, and is directed to a traffic channel where parametric measurements and voice tests can be performed. This radio-initiated test uses either the phone interconnect or dispatch call modes. While the call is in process, the unit measures the average power and SQE. It also provides simultaneous display of thermometer call status and decoded radio data.

You can now verify basic functionality without using valuable air time for testing. This features enables you to test in areas that are beyond the range of an actual system while also providing a more comprehensive measurement of radio performance. This ensures successful operation within the specification limits under all conditions.

Meter: DISPATCH Mode: IDEN MOBILE		RF Control: DUPLEX																
Mon Freq: 820.8125 MHz	SQE: +29.7 dB	Carr. #:1185																
Slots:16	Lvl:+ 34.4 dBm	Mon Freq:820.8125 MHz																
Gen Freq: 865.8125 MHz	Lvl:125.74 uV	Offset: +45.0000 MHz																
		Format: IDEN																
Call Seq: 1-2-3-4-5-6		Mon: 40 dB RF I/O																
Status: MS Talker		Gen: -865.8dBm RF I/O																
IMEI: 0001 00000238 07 0		Audio Sum: 0.00 U pk																
Classmark Information: Rev: 0 Pwr: 33 dBm		Fixed 1kHz: 0.00 U x																
		Synth: 0.00 U x																
		Format Sel: TONE A																
		Freq: 01000.0 Hz																
External: 0.00 U x																		
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AVG	INITIAL	6:1	3:1	DIS		stop	more											
WATTMTR	REG	INTRNCY	INTRNCY	PATCH														

Radio-compatible vocoder in both the generate and receive modes allows actual voice testing.

You can verify radio performance under actual voice conditions, providing you with absolute confidence in overall radio performance.

Meter: RF DISPLAY Mode: IDEN MOBILE		RF Control: DUPLEX																
Mon Freq: 820.8125 MHz	SQE: +29.2 dB	Carr. #:1185																
Slots:16	Lvl:+ 24.9 dBm	Mon Freq:820.8125 MHz																
Gen Freq: 865.8125 MHz	Lvl:125.74 uV	Offset: +45.0000 MHz																
		Format: IDEN																
Display: SPECTRUM ANALYZER		Mon: 20 dB RF I/O																
Dispersion: 20 kHz/div		Gen: -865.8dBm RF I/O																
SA:MANHLD	Mark:OFF	Audio Sum: 5.00 U pk																
Input Lvl (dBm)		Fixed 1kHz: 1.50 U x																
		Synth: 0.00 U x																
		Format Sel: TONE A																
		Freq: 01000.0 Hz																
External: 3.50 U ~																		
<table border="1" style="width:100%; text-align: center;"> <tr> <td>RF</td> <td>AC</td> <td>DC</td> <td>INT</td> <td>EXT</td> <td></td> <td>SINAD</td> <td>more</td> </tr> <tr> <td>DISPLAY</td> <td>VOLTS</td> <td>VOLTS</td> <td>DIST</td> <td>DIST</td> <td></td> <td></td> <td></td> </tr> </table>			RF	AC	DC	INT	EXT		SINAD	more	DISPLAY	VOLTS	VOLTS	DIST	DIST			
RF	AC	DC	INT	EXT		SINAD	more											
DISPLAY	VOLTS	VOLTS	DIST	DIST														

The R-2660 has the ability to exit the dedicated iDEN test screens to use other standard diagnostic capabilities such as spectrum analyzer, meters, etc., while still on active call.

This feature provides you with the capability to diagnose specific problems to facilitate repair.

Test Mode

Meter: BER TABLE Mode: IDEN TEST		RF Control: DUPLEX																
Errs: 4 Bits: 11000 BER: 0.0363%		Carr. #:1185																
Trig: AUTO Slots: 16 SQE: +23.1 dB		Mon Freq:820.8125 MHz																
Freq Err:- 875 Hz Input Lvl:- 91.0 dBm		Offset: +45.0000 MHz																
		Mon:1/6 Format: IDEN																
		Gen:1/6 W/C:OFF																
		ANT Gen: -850.8dBm RF I/O																
PREVIOUS BER MEASUREMENTS																		
SLOTS	BER	SQE	FREQ	ERR														
1. 16	0.0363%	+23.1 dB	- 875 Hz															
2. 16	0.0273%	+22.8 dB	- 875 Hz															
3. 16	0.0454%	+23.2 dB	- 874 Hz															
4. 16	0.0273%	+24.6 dB	- 872 Hz															
5. 16	0.0363%	+22.2 dB	- 875 Hz															
6. 16	0.0545%	+23.2 dB	- 875 Hz															
7. 16	0.0273%	+24.3 dB	- 876 Hz															
8. 16	0.0727%	+23.1 dB	- 875 Hz															
Audio Sum: 0.00 U pk																		
Fixed 1kHz: 0.00 U x																		
Synth: 0.00 U x																		
Format Sel: DPL																		
Code: 823																		
DTMF: 0.00 U x																		
Code:123456789*0#00BCD																		
External: 0.00 U x																		
<table border="1" style="width:100%; text-align: center;"> <tr> <td>AVG</td> <td>BER</td> <td>BER</td> <td></td> <td>clear</td> <td>stop</td> <td>more</td> </tr> <tr> <td>WATTMTR</td> <td>TABLE</td> <td></td> <td></td> <td>table</td> <td></td> <td></td> </tr> </table>					AVG	BER	BER		clear	stop	more	WATTMTR	TABLE			table		
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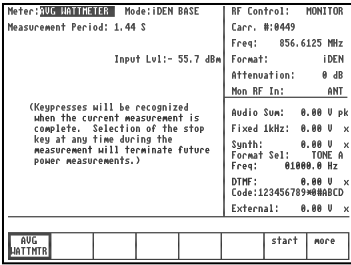
With the subscriber radio in test mode, the R-2660 provides the capability to measure the performance of the transmitter. The unit measures the following parameters under TDMA modulating conditions: BER, over selectable time intervals; output power, averaged during selectable measurement intervals; frequency; and SQE. Results can be presented in a real-time display or in a table of the eight most recent readings of BER, frequency and SQE. A dedicated screen exists for average power measurements.

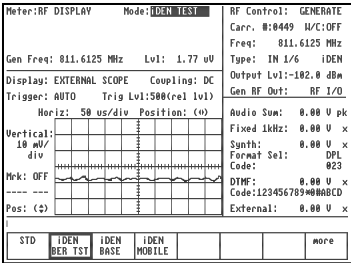
Test mode allows you to perform quantitative testing of the subscriber unit's transmitter under actual TDMA conditions to aid in the diagnosis of problems and ensure proper system performance.

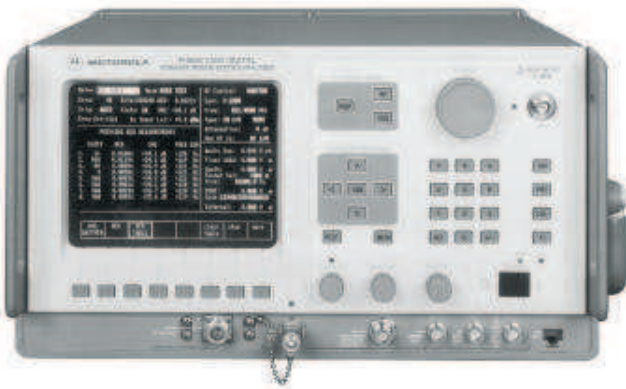
With the subscriber radio in test mode, the R-2660 generates a BER pattern to test the sensitivity and demodulator performance.

This feature allows you to perform quantitative testing of the radio's receiver under actual TDMA conditions to aid in the diagnosis of problems and ensure proper system performance of the radio.

iDEN Fixed Site Testing

Feature	Description	Benefits
Base Site Transmitter Testing 	<p>The R-2660 measures average power level, frequency, and SQE under actual operating conditions. A dedicated screen is provided for average power measurements with a selectable averaging interval. SQE provides a quantitative indication of modulation quality.</p>	<p>This feature allows you to monitor performance under traffic conditions without powering down the channel. It can also be done with the transmitter in an off-line test mode.</p>

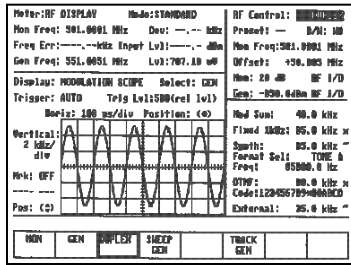
Base Receiver BER Test 	<p>With the base receiver in its test mode, the R-2660 will generate a carrier modulated with a standard bit pattern in order to perform a receiver bit error rate (BER) test. This can test the receiver's sensitivity as well as its demodulator performance.</p>	<p>This feature provides quantitative testing under actual TDMA conditions to aid in the measurement of receiver sensitivity and demodulator performance.</p>
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Standard System Features

Feature	Description	Benefits
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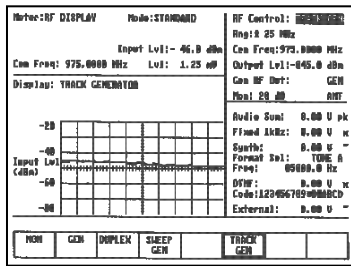
Duplex



Full output level control from -130 dBm to 0 dBm over the entire range of the instrument is available from the RF I/O port (-130 dBm up to -50 dBm) and the generation port (-80 dBm to 0 dBm). Variable offsets from 0 to ± 55 MHz in 5 kHz steps are keypad selectable.

The duplex generator provides enhanced capability to service equipment such as repeaters and full duplex radios, including cellular telephones. Full RF level control as well as full internal and external modulation capability allows receiver (desensitization) and transmitter tests to be performed simultaneously through one port, if desired. Storage of test setups is available in memory for instant recall.

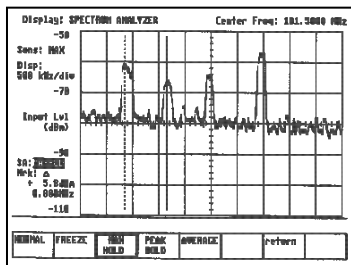
50 MHz Tracking Generator



The combining of the capabilities of the sweep generator and the spectrum analyzer into a Tracking Generator function allows the user to view the performance characteristics of many RF filter devices. Display range is operator selectable from a 200 kHz window up to a 50 MHz window anywhere in the 400 kHz to 1 GHz spectrum.

Diagnosis and adjustment of critical receiver front ends, IFs, helical filters, cavities, combiners and duplexers can be made in a few minutes, quickly and easily with the flexibility of the R-2660's tracking generator at your fingertips.

Spectrum Analyzer (See & Hear)TM



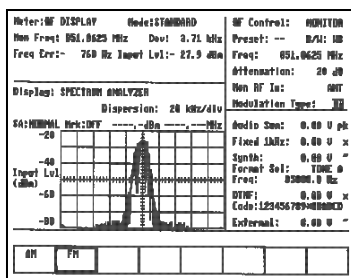
The built-in Spectrum Analyzer of the R-2660 will display a window of RF spectrum anywhere within the 400 kHz to 1 GHz operating range of the unit. The EXPAND softkey enlarges the display to fill the CRT and retains dispersion and center frequency control.

The R-2660 also includes Markers and a 100 MHz Window. These Markers provide the following features:

- Freeze
- Max Level Hold
- Peak Level Hold
- Absolute Level & Frequency
- Delta Level & Frequency

The ability to observe the spectrum display and then store it for detailed analysis through the use of multiple Markers provides a significant advantage. The Tuning Knob retains control of the center frequency even in the EXPAND mode to perform fast sweeps or fine tuning. This allows you to quickly locate and identify signal carriers.

Terminated RF Wattmeter



RF power anywhere in the operating range of 400 kHz to 1 GHz is automatically measured by the Communications System Analyzer tuned to that frequency. The built-in RF load dissipates up to 125 watts for one minute. If a high power transmitter is keyed into the unit for any longer, the CRT display changes to read "WARNING RF OVERLOAD" thus warning the technician to un-key.

This feature provides calibrated RF power measurements eliminating the need for a separate wattmeter. The CRT display also includes frequency error and modulation level simultaneously.

Programmable Test Memory

MEMORY	Current Preset --	Test Setup	
Mem Freq (MHz)	Mem Freq (MHz)		
00	999.9999	151 999.9999	503 Tr Test
01	999.9999	161 999.9999	513 Rx Test
02	999.9999	171 999.9999	523 Dup Test
03	999.9999	181 999.9999	533 Factory Default
04	999.9999	191 999.9999	543 Factory Default
05	999.9999	201 999.9999	553 Factory Default
06	999.9999	211 999.9999	563 Factory Default
07	999.9999	221 999.9999	573 Factory Default
08	999.9999	231 999.9999	583 Factory Default
09	999.9999	241 999.9999	593 Factory Default
10	999.9999	251 999.9999	603 Factory Default
11	999.9999	261 999.9999	613 Factory Default
12	999.9999	271 999.9999	623 Factory Default
13	999.9999	281 999.9999	633 Factory Default
14	999.9999	291 999.9999	643 Factory Default

Channel Presets – The unit has 30 memory locations which can be used to store preset channel information. Channels can be easily selected individually or automatically scanned over a user defined range.

Programmable Test Setups – You can easily program and store up to 15 of the most commonly used test setups, including all test conditions, measurement display formats, and levels. These memory positions operate fully independently from the channel presets.

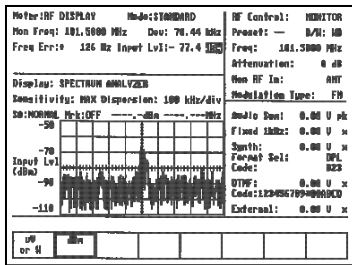
Channel Presets – This feature allows you to quickly access frequently used channel location information to speed testing. Scanning allows automatic monitoring and measurement of activity on channels of interest.

Programmable Test Setups – You can significantly reduce the number of key presses required to set up the more commonly used test setups, greatly increasing your efficiency while promoting uniform test procedures. You can also assign a custom name to the test for easy recall.

Standard System Features

Feature	Description	Benefits
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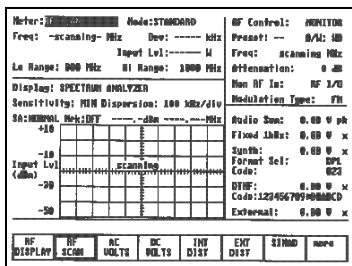
Relative Signal Strength Meter



In addition to reading frequency error and modulation, a digital readout relative signal strength meter has been included. Sensitivity is specified to -100 dBm at the antenna port for FM signals and extends up to 125 watts at the RF I/O port. The CRT display will automatically convert to a terminating "watts" display as the level increases.

This feature, in conjunction with an external antenna, allows remote monitoring of distant transmitters to check for antenna, transmission line or P.A. problems. Many technicians also find this feature convenient in performing propagation studies to identify weak coverage areas.

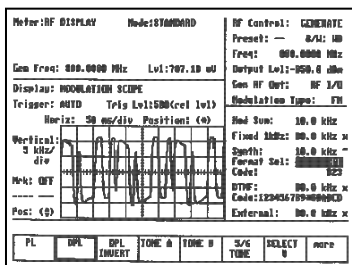
RF Scan/RF Counter Function



RF Scan operates in the monitor mode and provides a function similar to a 1 GHz counter. This feature automatically scans a user defined frequency range to lock to the signal applied. Any RF carrier above 20 MHz can be located within 5 seconds or less and the reception displayed with digital readouts.

It is possible to locate and identify the operating frequencies of multi-channel radios. This feature allows the technician to conveniently and immediately verify the programming of a multi-channel radio. By automatically tuning the R-2660 receiver to the detected carrier, immediate measurement data can be taken without having to enter new frequency via the keyboard. The 1 GHz counter on your bench is now obsolete.

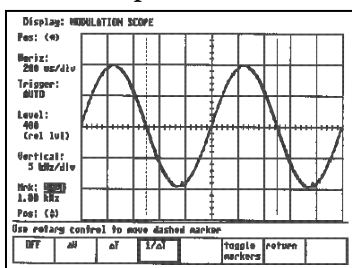
Signaling Simulator: Encoder and Decoder



The System Analyzer includes the capability of encoding and decoding PRIVATE LINE (PL), DIGITAL PRIVATE LINE (DPL), and single tone sequences as well as multi-tone sequences including DTMF signals, 5/6 tone paging, Select V and up to 20 sequential tones. Decoding displays include tone frequencies and time durations of the individual tones. The unit can also encode tone remote signaling.

The signaling capability of the R-2660 reaches a broader range of service applications with its decode capability. This gives the service technician a more flexible test instrument which aids in servicing paging equipment, specialized signaling encoders as well as mobile, portable and other radio products. The signaling simulator can perform a full system check-out faster, with more accuracy than ever before.

General Purpose & Modulation Oscilloscope



The oscilloscope has a 50 kHz bandwidth for audio waveform analysis. The display can be triggered over the full screen range to a fixed reference level. Triggering in both automatic and normal modes is provided for synchronizing the horizontal timebase to the vertical input signal. Internal or external inputs allow observation of both generated and monitored modulation signals. Softkeys provide for an enlarged full screen display.

Recovered audio or internally produced audio can be displayed visually for deviation measurements. Additionally, detection of an asymmetric modulation or audio distortion can be achieved with waveform analysis. With internal and external triggering and a freeze display single sweep, this unit duplicates many features of more expensive scopes. The markers allow detailed analysis to measure waveforms displayed on the CRT. The EXPAND function provides an uncrowded, easy to interpret view of the signal for quick analysis.

Markers

Functional Markers include the following features:

- Delta Voltage
- Delta Period
- Delta Frequency

Standard System Features

Feature	Description	Benefits
AM, FM Signal Generator	When the GENERATE mode is selected, the RF modulation method, carrier frequency, bandwidth, composite audio modulation, and RF signal level output are displayed on the CRT.	In addition to reducing receiver test time, this flexible, self-calibrating signal generator is complemented by the simultaneous display of all the necessary control information.
Off-the-Air Sensitive Receiver	The 2 microvolt sensitivity of the R-2660 is available through the antenna port. This allows off-the-air monitoring of remote transmitters operating up to 1 GHz. Variable squelch aids in picking up weak signals but can be set tighter to ensure the proper S/N ratio for measurement accuracy.	This feature reduces service costs by enabling frequent preventive maintenance, system degradation parameter checks or interference identification without leaving the shop.
Graphic Screen Print, and Self-Calibration	These commands are provided as immediate action functions. Dedicated keys on the front panel provide easy access.	Graphic screen print provides hardcopy of test data, thereby improving the quality of your documentation. Self-calibration ensures measurement accuracy of RF input, output and modulation at the touch of a button.
RS-232/Serial Printer Interface	A full bi-directional RS-232 port is standard and includes the capability to respond to serial input command vocabulary and return measurement results as a serial output stream. Included are user-selectable baud rates (up to 9600 bps) and start, stop and parity bit selection. In addition, this dual function port can drive an optional serial printer to print out data and graphic displays.	Without ever leaving the shop, this feature allows remote monitoring of cell sites and off-the-air measurements of radio equipment located out of range. If you have large volume repetitive testing requirements, this feature allows you to write your own programs to reduce test time costs. Printed results can be used as part of the service shop's internal quality control system and can be used to demonstrate performance to the radio equipment user.
IEEE-488.2 Interface (Optional)	The R-2660 provides the necessary interface hardware and software for 488.2 bus operation.	IEEE-488.2 interface capability enables the System Analyzer to perform fully automated testing. Any one of the various programmable controllers are suitable for this application.
Cable Fault	Cable fault distance and cable length are RF measurement features which help the technician isolate cable defects. Supported by on-screen prompts and user-selectable Help messages, you can quickly set up and accurately determine the distance to a fault on a coaxial cable. The distance to fault (or cable length) is computed and displayed in feet or metric units.	Cable fault locating techniques are mandatory for site servicing, where visual inspection is not practical, safe or effective in detecting hidden or cold-flow damage. The semi-automatic operation of the cable fault finder precludes the use of mathematical formulas and manual calculations, maximizing your onsite productivity.

Specifications

Operating/Display	
Modes:	AM/FM Monitor AM/FM Generate Audio Synthesizer Spectrum Analyzer Duplex Generator Sweep Generator Tracking Generator Cable Fault Locator Frequency Counter Digital Voltmeter Wattmeter Oscilloscope Signal Strength Meter SINAD/Distortion Meter

RF Signal Generator	
FREQUENCY	Range: 400 kHz to 1 GHz Resolution: 100 Hz Accuracy: Refer to Accuracy of Master Oscillator Stabilization Time: .1 Second
OUTPUT	Range FM: -130 dBm to 0 dBm Range AM: -130 dBm to -3 dBm Accuracy: ± 2 dB from -80 dBm to -130 dBm (RF I/O PORT) ± 4 dBm for all other output levels and ports. 3 MHz to 1 GHz
SWEEP GENERATOR	Range: 400 kHz to 1 GHz Resolution: 100 Hz Output: -130 dBm to 0 dBm Sweep Width: Selectable up to ± 5 MHz of center freq. Scope Coupling: Synchronized scope trace to the sweep signal Accuracy: Same as Signal Generator
DUPLEX GENERATOR	Range: 400 kHz to 1 GHz Resolution: 100 Hz Output: -130 dBm to 0 dBm Frequency Offset: 0 MHz to ± 55 MHz in 5 kHz steps Accuracy: Same as Signal Generator
SPECTRAL PURITY	Spurious: -35 dBc within ± 20 MHz of selected carrier frequency. Additional fixed spurs at an absolute level of < 90 dBm at harmonic frequencies of 5 MHz. (These can effect level and modulation measurements when operated at low levels at or very near these specific frequencies.) Harmonics: -20 dB below fundamental
FM MODULATION	Deviation: 99.5 kHz Accuracy: 5% of setting ± 25 Hz @ 1 kHz (NB) 5% of setting ± 250 Hz @ 1 kHz (WB) Residual FM: 20 Hz max @ 300 Hz to 3 kHz audio bandwidth External/Internal Frequency Range: 5 Hz to 20 kHz, ± 2 dB
AM MODULATION	Range: 0 to 90% Resolution: 10% of modulation Residual AM: 1.0% max @ 300 to 3 kHz audio bandwidth External/Internal Frequency Range: 100 Hz to 10 kHz, ± 1 dB
PHASE MODULATION (Optional)	Range: 0.5 to 10 radians Accuracy: $\pm 8\%$ at 1 kHz Resolution: .1 radians (.01 below 2.00 radians) External/Internal Frequency Range: 300 to 3000 Hz

Audio Modulation Synthesizer	
Modulation Types:	1 kHz tone, PRIVATE LINE, DIGITAL PRIVATE LINE, Single Tone DTMF, Two-Tone Paging, 5/6 Tone Paging, International Select V, 20 Tone General Sequence, Tone Remote Control, External inputs from both a supplied microphone and BNC input.
Frequency Range:	10 Hz to 20 kHz ± 1 dB
Mod Output Level:	Programmable into 7.95 v peak
Mod Output Impedance:	100 ohms nominal
1 kHz Tone Distortion:	Not to exceed 1%
External Modulation Inputs:	Front panel microphone and a BNC jack are summed.
BNC Input Impedance:	600 ohms nominal
Microphone Supplied:	HMN-1056D
Microphone Input Conditioning:	Internal audio limiting providing IDC and pre-emphasis.

RF Receiver	
FREQUENCY	Range: 400 kHz to 1 GHz Resolution: 100 Hz Accuracy: Refer to Accuracy of Master Oscillator Spurious Response: 40 dB typical
SENSITIVITY (Above 10 MHz)	Narrowband FM: 2.0 uV for 10 dB EIA SINAD Wideband FM: 10 uV for 10 dB EIA SINAD
FREQUENCY ERROR METER	Type of Display: Autoranging Resolution: 1 Hz
FM DEVIATION MEASUREMENT	Demod Range: Up to ± 5 kHz in Narrowband Up to ± 75 kHz in Wideband Accuracy: $\pm 5\%$ plus peak residual FM Frequency Response: Selectable per the following: <u>Low Pass Filters</u> 300 Hz, 3 kHz, 20 kHz <u>High Pass Filters</u> 5 Hz, 300 Hz, 3 kHz Demodulated Output Level: .8 v peak per 1 kHz peak Deviation in Narrowband and per 10 kHz Deviation in Wideband Demodulation Output Impedance: 100 ohms nominal Deviation Alarm: Audible, set via keypad in 100 Hz increments
AM MODULATION MEASUREMENTS	Demodulation Range: 0 to 100% Accuracy: $\pm 5\%$ for levels below 80% Frequency Response: Selectable per the following: <u>Low Pass Filters</u> 300 Hz, 3 kHz, 20 kHz <u>High Pass Filters</u> 5 Hz, 300 Hz, 3 kHz Demodulated Output Level: .8 v peak per 10% AM modulation

Specifications

RF Receiver (Cont.)	
PHASE DEMODULATION MEASUREMENTS (Optional)	
Demod Range:	Narrowband = 1 radian Wideband = 10 radians
Accuracy/ Frequency Response:	$\pm 5\% \pm 0.1$ rad, \pm residual noise at 1 kHz, $\pm 7.5\% \pm 0.1$ rad, \pm residual noise 300 Hz to 3.5 kHz

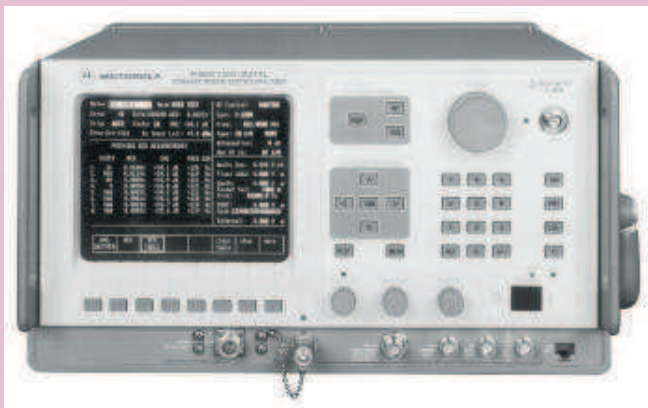
iDEN Tests	
FORMATS SUPPORTED	
iDEN 6:1:	Subscriber dynamic call testing in dispatch and interconnect modes; live site monitoring, test mode
iDEN 3:1:	Subscriber dynamic call testing in interconnect mode
DJSMR:	Test mode only
DMCA:	Test mode only
DYNAMIC CALL TEST MODE:	<ul style="list-style-type: none"> • Simulates system to test subscriber radios under actual operating condition • Tests control channel access, registration and traffic channel access • Tests dispatch in 6:1 mode • Tests interconnect calls in either 3:1 or 6:1 mode • Vocoder provides live voice testing of both transmitter and receiver • Access is provided to diagnostic measurement capabilities during live calling conditions
AVERAGE WATTMETER PERFORMANCE	
Range:	0.5 W to 125 W _{peak}
Accuracy:	$\pm 15\%$
Period Selection	
Range:	90 mS to 4.32 mS
Increment:	90 mS
FREQUENCY ERROR RANGE	
Monitoring Test mode:	< ± 400 Hz
Monitoring Live Base Site Radio:	< ± 1800 Hz
SQE MEASUREMENT SPECIFICATIONS	
Resolution:	0.1 dB
Range:	0 to 99.9 dBm

iDEN Tests (Cont.)	
BER Test Mode:	(BER Specifications are for predefined data sequence. Percentages are averaged over 960 slots).
Generator BER Floor	
Gen Port Range:	Gen BER <0.01% for levels -19.9 to -10 dBm Gen BER <0.005% for levels -80 to -20 dBm
RF I/O Port Range:	Gen BER <0.005% for levels -130 to -70 dBm
Generator BER	
Duty Cycle Selection:	Subscriber 1/6 Site 1/6, 4/4, 6/6
MONITOR BER MEASUREMENT SPECIFICATIONS (for Predefined Data Sequence)	
Input Duty Cycle Selections:	Subscriber 1/6
Slot Number Selections:	4, 16, 80, 960
BER Measurement Floor:	.005%
Output Ports:	Baseboard I & Q output Slot sync output



Specifications

Metering & Measurement	
SPECTRUM ANALYZER SEE AND HEAR™	Frequency Range: 400 kHz to 1 GHz Dispersion: Selectable from keypad per following: 200 kHz window - (20 kHz per division) 500 kHz window - (50 kHz per division) 1 MHz window - (100 kHz per division) 2 MHz window - (200 kHz per division) 5 MHz window - (500 kHz per division) 10 MHz window - (1 MHz per division) 20 MHz window - (2 MHz per division)* 50 MHz window - (5 MHz per division)* 100 MHz window - (10 MHz per division)* * Not functional in MIRS mode Dynamic Range: 60 dB Bandwidth: Automatically selected 6 kHz 100 kHz/division & below 30 kHz 200 kHz/division & above Display Range: +50 to -95 dBm Markers: Freeze, Max Hold, Peak Hold Delta or Absolute level and frequency
SIGNAL STRENGTH INDICATOR	Range: 3 MHz to 1 GHz Accuracy: ±4 dB Sensitivity: -100 dBm (antenna port rating)
WATTMETER (RF I/O PORT)	Frequency Range: 3 MHz to 1 GHz Measurement Range: .1 watt to 125 watts (intermittent duty) Input Impedance: 50 ohms with maximum VSWR of 1.5:1 Accuracy: ±10% Protection: Over temperature alarms
TRACKING GENERATOR	Frequency Range: 400 kHz to 1 GHz Tracking Display Sweep Range: 200 kHz window - (20 kHz per division) 500 kHz window - (50 kHz per division) 1 MHz window - (100 kHz per division) 2 MHz window - (200 kHz per division) 5 MHz window - (500 kHz per division) 10 MHz window - (1 MHz per division) 20 MHz window - (2 MHz per division) 50 MHz window - (5 MHz per division) Display Range: 0 to -80 dBm
CABLE FAULT	Method: Standing Wave Analysis Measure: Fault distance, cable length Reading: Feet and meters Accuracy: 10%



Metering & Measurement (Cont.)	
OSCILLOSCOPE	CRT Size: 9 cm x 11 cm (approx. 7 inch diagonal) Frequency Response: 0 to 50 kHz Vertical Input Ranges: Selectable per the following: 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1v, 2v, 5v, 10v per division Accuracy: 5% of full scale all ranges Sweep Ranges: Selectable per the following: 20 usec, 50 usec, 100 usec, 200 usec, 500 usec, 1 msec, 2 msec, 5 msec, 10 msec, 20 msec, 50 msec, 100 msec, 200 msec, 500 msec, 1 sec per division Trigger: Automatic, normal, and single sweep Markers: Delta Voltage, Delta Frequency, Delta Period
DIGITAL VOLTMETER	Meter Type: RMS Frequency Range: DC plus AC of 50 Hz to 20 kHz DC Voltage Ranges: 1.0 V, 10.0 V, 100.0 V full scale Accuracy: 1% full scale ±1 least significant digit AC Voltage Ranges: 1.0 V, 10.0 V, 70.0 V full scale Accuracy: 5% full scale ±1 least significant digit Freq. Response: 3 dB end points @ 50 Hz and 20 kHz
FREQUENCY COUNTER	Frequency Range: 5 Hz to 500 kHz plus Auto Tune Period Counter Range: 5 Hz to 20 kHz Input Level: .1 v RMS minimum input level Resolution: .1 Hz, 1 Hz, 10 Hz, 100 Hz, and 1kHz varying by frequency range Auto Tune: Monitor mode, 20 MHz to 1 GHz, unit will scan and find signals greater than -30 dBm Accuracy: See TIME BASE
SINAD/DISTORTION METER	Input Level: .1 V to 10 V RMS SINAD Accuracy: ±1 dB at 12 dB SINAD Distortion Range: 1% to 20% Distortion Accuracy: ±0.5% of distortion or ±10% of reading whichever is greater Optional: C-Message Filter; CCITT Filter w/600 ohm switchable load
TONE SEQUENCE DECODE	Modulation Types: PRIVATE LINE, DIGITAL PRIVATE LINE, Single Tone, DTMF, Two-Tone Paging, 5/6 Tone Paging, International Select V, 20 Tone General Sequence. Frequency Accuracy: ±3 % from 300 Hz to 3 kHz Distortion Accuracy: ±12 msec for tones greater than 30 msec and 300 Hz
RS232 PORT (Requires Special Cable)/Optional IEEE488.2	Bidirectional port provided with capability to respond to serial (optional parallel) input command vocabulary to activate functions and return measured results. Baud rates to 9600 bps with selectable start, stop, and parity bits.
TIME BASE	Standard OCXO: Aging .5 ppm/yr, Temperature .05 ppm

Specifications

Power and Environmental	
AC:	100 to 130 VRMS or 200 to 260 VRMS @ 50 Hz to 440 Hz
DC:	+11 to +16 VDC
Battery Option:	13.6 V, 50 minutes typical
Dimensions:	8.5" high x 16" wide x 17" deep (21.6 cm x 40.7 cm wide x 43.2 cm) excluding accessories, battery pack and cover
Weight:	37 pounds (Basic model excluding accessory cover)
Temperature:	0°C to +50°C (operating) -40°C to +85°C (storage)

Interface Ports	
Printer/Remote Control:	RS-232 DB25 (female)
Color Monitor:	Standard CGA, RGB DB9 (female)

Model Nomenclature	
Communications System Analyzer w/iDEN Digital Capability	R-2660B
FACTORY INSTALLED OPTIONS: (Order as additional line items with Basic Model R-2660)	
IEEE 488.2	RLN-4329A
ACCESSORIES SUPPLIED:	
Microphone	HMN-1056D
Power Cord	30-80397A62
Whip Antenna	TEKA-24A
Signal Generator Termination (50 ohm)	58-80386B73
Oscilloscope Probe	RTL-4011A
BNC to N Adapter	58-84300A98
DC Power Connector Kit	RPX-4097A
Spare RF Fuses	GG-6530277C002
R-2660 Operator's Manual	68-80309F16
RF Detector Probe (req'd for Cable Fault testing)	RTL-4075A
BNC RF "T" (req'd for Cable Fault testing)	09-82578B01
OPTIONAL ACCESSORIES:	
Battery Pack	RPN-4000A
Canvas Case	15-80357B77
Transit Case	A-001
Telescoping Antenna	RTA-4000A
RF Detector (50 Ohm Termination)	58-80345B96
Serial / Parallel	
Dot Matrix Printer	RLN-4375A
Serial Printer Cable	30-80387B58
CGA Monitor Cable (DB9M - DB9M)	30-80387B60
RS-232 Cable (DB25M - DB9F)	30-80387B59
RS-232 Adapter (DB9M - DB25F)	HLN-9390A
Programming Reference Manual (RS-232 & IEEE)	68-80309E55
Service Manual	RLN-4120C

